

REMARKS

Claims 1-30 were pending. Claims 1-15 and 19-27 have been canceled without prejudice or disclaimer. Claims 16 and 28 have been amended. Claims 31 and 32 have been added. Reconsideration of the present application is respectfully requested.

At the outset, the Examiner is thanked for the thorough review and consideration of the present application. The Examiner's Office Action dated September 2, 2003 has been received and the contents carefully noted.

The specification has been amended to correct minor grammatical informalities. No new matter has been added.

The Examiner rejected claim 14 under 35 USC 102(b) as being clearly anticipated by Imai et al. (US Patent No. 5,373,171). This rejection is deemed moot in view of the cancellation of claim 14.

The Examiner rejected claims 16-18 and 28-30 under 35 USC 102(b) as being anticipated by Carter et al. (US Patent No. 6,025,289). This rejection is respectfully traversed.

Claim 16 is allowable at least for the reason that claim 16 recites a silicon carbide single crystal including, for example, a metallic atom, other than a light metal, having a larger atomic radius than silicon in a crystalline structure thereof and including tantalum.

Claim 28 is allowable at least for the reason that claim 28 recites a silicon carbide single crystal including, for example, an atom having a smaller atomic radius than silicon and including fluorine contained in a carbon fluoride gas.

In the present invention, an SiC single crystal is produced in which controllability of both resistivity and polymorphism is achieved. More specifically, formation of heterogeneous polymorphism caused by distortion in the crystal due to compression or

expansion is prevented so as to provide an SiC single crystal having high quality and low resistivity.

An n-type dopant atom having a smaller atomic radius than silicon has a compression function of crystals. In the case where the resistivity is controlled by the n-type dopant atom, when a metallic atom other than a light metal having a larger atomic radius than silicon is added, the metallic atom substituted on the Si site has an expansion function of crystals. Thus, it counteracts the compression function of the n-type dopant atom.

A p-type dopant atom having a larger atomic radius than carbon and an atom having a smaller atomic radius than silicon may also be used to grow a SiC single crystal. The p-type dopant atom is at least one selected from boron, aluminum and gallium. The atom having a smaller atomic radius than silicon includes fluorine contained in a carbon fluoride gas to eliminate distortion in the crystal caused by expansion.

Carter et al. ('289) discloses colorless silicon carbide crystals grown with p-type and n-type dopants. Aluminum is used as the p-type dopant and nitrogen is used as the n-type dopant.

However, Carter et al. ('289) fails to disclose the features recited in claim 16, namely, a metallic atom including tantalum that has a larger atomic radius than silicon in a crystalline structure thereof, to achieve the novel and nonobvious advantages of the present invention. In addition, Carter et al. ('289) fails to disclose the features recited in claim 28, namely, an atom including fluorine contained in a carbon fluoride gas having a smaller atomic radius than silicon.

Instead, Carter et al. ('289) teaches using an n-type dopant and a p-type dopant simultaneously. There is no discussion of using a metallic atom including tantalum or an

atom including fluorine contained in a carbon fluoride gas.

It can thus be understood that the reference does not in any way anticipate the essential features of the present invention as set out in independent claims 16 and 28.

Moreover, as claims 17, 18, 29, and 30 depend from one of independent claims 16 and 28, these claims are also allowable for the same reasons as its respective base claim.

Therefore, Applicants respectfully request that the rejection of claims 16-18 and 28-30 under 35 USC 102(b) be withdrawn.

The Examiner rejected claims 16-18 under 35 USC 102(e) as being anticipated by Carter, Jr. et al. (US Patent No. 6,218,680). This rejection is respectfully traversed.

Claim 16 is allowable at least for the reason that claim 16 recites a silicon carbide single crystal including, for example, a metallic atom, other than a light metal, having a larger atomic radius than silicon in a crystalline structure thereof and including tantalum.

Carter, Jr. et al. discloses a semi-insulating silicon carbide without vanadium domination. The silicon carbide single crystals include nitrogen atoms and low levels of vanadium.

However, Carter, Jr. et al. fails to disclose the features recited in claim 16, namely, a metallic atom including tantalum which has a larger atomic radius than silicon in a crystalline structure thereof, to achieve the novel and nonobvious advantages discussed in the present invention.

It can thus be understood that the reference does not in any way anticipate the essential features of the present invention as set out in independent claim 16.

Moreover, as claims 17 and 18 depend from independent claim 16, these claims are also allowable for the same reasons as its respective base claim.

Therefore, Applicants respectfully request that the rejection of claims 16-18 under 35 USC 102(e) be withdrawn.

The Examiner rejected claims 16-18 under 35 USC 102(b) as being anticipated by Carter et al. (US Patent No. 5,718,760). This rejection is respectfully traversed.

Claim 16 is allowable at least for the reason that claim 16 recites a silicon carbide single crystal including, for example, a metallic atom, other than a light metal, having a larger atomic radius than silicon in a crystalline structure thereof and including tantalum.

Carter et al. ('760) discloses growing colorless silicon carbide crystals using p-type and n-type dopants. Aluminum is used as the p-type dopant and nitrogen is used as the n-type dopant.

However, Carter et al. ('760) fails to disclose the features recited in claim 16, namely, a metallic atom including tantalum which has a larger atomic radius than silicon in a crystalline structure thereof, to achieve the novel and nonobvious advantages discussed in the present invention.

Instead, Carter, Jr. et al. ('760) teaches simultaneously growing SiC using an n-type dopant and a p-type dopant. There is no discussion of using a metallic atom including tantalum.

It can thus be understood that the reference does not in any way anticipate the essential features of the present invention as set out in independent claim 16.

Moreover, as claims 17 and 18 depend from independent claim 16, these claims are also allowable for the same reasons as its respective base claim.

Therefore, Applicants respectfully request that the rejection of claims 16-18 under 35 USC 102(b) be withdrawn.

The Examiner rejected claim 15 under 35 USC 103(a) as being unpatentable over Imai et al. (US Patent No. 5,373,171). This rejection is deemed moot in view of the cancellation of this claim.

The Examiner rejected claim 15 under 35 USC 103(a) as being unpatentable over Imai et al. (US Patent No. 5,373,171) in view of Suzuki et al. (US Patent No. 5,063,421). This rejection is deemed moot in view of the cancellation of this claim.

The Examiner rejected claims 16-18 under 35 USC 102(b) as anticipated by or, in the alternative, under 35 USC 103(a) as obvious over, Carter et al. (US Patent No. 5,718,760) or Carter et al. (US Patent No. 6,025,289) in view of Larkin et al. (US Patent No. 5,709,745). This rejection is respectfully traversed.

Claim 16 is allowable at least for the reason that claim 16 recites a silicon carbide single crystal including, for example, a metallic atom, other than a light metal, having a larger atomic radius than silicon in a crystalline structure thereof and including tantalum.

As discussed above, Carter et al. ('760) discloses growing colorless silicon carbide crystals using p-type and n-type dopants, and Carter et al. ('289) discloses colorless silicon carbide crystals grown with p-type and n-type dopants. Aluminum is used as the p-type dopant and nitrogen is used as the n-type dopant.

Larkin et al. teaches compound semi-conductors and controlled doping thereof. Phosphorus and nitrogen atoms are added to form n-type layers, and aluminum and boron are added to form p-type layers.

However, as discussed above, Carter et al. ('760) and Carter et al. ('289) fail to disclose the features recited in claim 16, namely, a metallic atom including tantalum which has a larger atomic radius than silicon in a crystalline structure thereof, to achieve the novel and nonobvious advantages discussed in the present invention.

Carter et al. ('760) and ('289) were discussed above as not anticipating the invention, and since anticipation is the "ultimate or epitome of obviousness", *see, In re Kalm*, 54 CCPA 1466, 1470, 378 F.2d 959, 962, 154 USPQ 10, 12 (1967), the essential features of claim 16 are also not obvious over the references.

Larkin et al. fails to cure the deficiencies of the base references. Larkin et al. merely teaches simultaneously using n-type and p-type dopants. However, there is no discussion of using a metallic atom including tantalum.

It can thus be understood that the combination of references does not in any way anticipate or make obvious the essential features of the present invention as set out in independent claim 16.

Moreover, as claims 17 and 18 depend from independent claim 16, these claims are also allowable for the same reasons as its respective base claim.

Therefore, Applicants respectfully request that the rejection of claims 16-18 under 35USC 102(b)/35 USC 103(a) be withdrawn.

Newly added dependent claim 31 further limits claim 17 by further reciting features regarding the n-type dopant atom. Newly added dependent claim 32 further limits claim 29 by further reciting features regarding the p-type dopant atom. Support for these new claims may be found in the specification for example at page 14, lines 11-18, and page 22, lines 7-12.

In view of the above remarks and amendments, the present application is believed to be in condition for allowance. A prompt notice to that effect is respectfully requested.

A one-month extension and the requisite fee are included with this Amendment.

Although no additional fees are believed to be due, permission is hereby given to charge any unforeseen fees to deposit account 50-1147.

Respectfully submitted,

A handwritten signature in black ink, appearing to read 'DGP', with a stylized flourish extending from the end.

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